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PARAHO-UTE PROJECT

Uintah County, Utah

DIVISION OF  
OIL, GAS & MINING

ENVIRONMENTAL MONITORING PLAN OUTLINE

PARAHO DEVELOPMENT CORPORATION

Denver, Colorado

October 28, 1982

PARAHO-UTE PROJECT  
ENVIRONMENTAL MONITORING PLAN OUTLINE

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## PREFACE TO OUTLINE

This environmental monitoring plan outline is presented in narrative form to allow a brief explanation of the monitoring approach being developed and the monitoring parameters being considered. Four major Sections are envisioned:

- o Introduction
- o Ambient Monitoring Program
- o Source Monitoring Program
- o Occupational Health and Safety Monitoring Program

The monitoring terms are intended to comply with SFC requirements under Section 131(e) of the Energy Security Act, and will be incorporated into any financial assistance agreement with SFC. It is envisioned that the research oriented monitoring parameters required by SFC would terminate at the completion of SFC financial involvement. Programs required by other federal, state and local agencies and those programs required by permit conditions and associated regulations would be continued.

## I. INTRODUCTION

Monitoring programs developed for major industrial developments since the mid- to early 1970s have typically measured all variables that were conceivably of environmental significance. Paraho believes that it can develop a more focused and effective monitoring program by utilizing existing data for contiguous oil shale sites, Paraho processes and site characterization data, and by participating in shared monitoring efforts. Thus, Paraho proposes to couple site-specific environmental knowledge (i.e. water chemistry) with data on the Paraho process (i.e. waste water effluents).

### Paraho Project

A project description will be provided which will include a project history, a site description, and details of the process and environmental control technology.

### Monitoring Approach

The purpose of this monitoring plan is to: document and quantify on-site environmental resources; provide information needed to demonstrate compliance with appropriate statutes and agency requirements; provide timely notice of detrimental effects or conditions, and provide information concerning the mitigation measures implemented for the project.

In order to achieve these objectives, Paraho will conduct monitoring programs for the ambient environment, source emissions, and occupational health and safety. These programs will be designed carefully and will fully describe the methods to be used, parameters to be measured, techniques for data analysis, and quality assurance/quality control procedures to be implemented.

Ambient Monitoring Program. The ambient monitoring program includes periodic measurement of ground water, surface water, air, wildlife, vegetation and soils. Thus, ambient monitoring refers to monitoring of the unconfined environment in the vicinity of the Paraho facility. Each of these environmental resources is addressed separately with unique methods of data collection, analysis and scope. Where appropriate, data will be collected during similar time periods or from the same sample site so that comparisons between environmental components can be made.

Source Monitoring. The source monitoring program is designed to periodically determine the composition of discharge and waste streams from the retorting and upgrading process. The program is divided into components corresponding to the major steps in the Paraho process. These are: mining, crushing and screening; final screening and shale storage; retorting and shale oil recovery; processed shale disposal; ammonia removal and sulfur recovery; hydrotreating; shale oil storage; product distribution; waste water treatment, and power generation. These units will be monitored for airborne and gaseous emissions, wastewater and liquid effluent, solid waste, and other miscellaneous emissions from the Paraho process.

Occupational Safety and Health Monitoring. This monitoring program will include identification of possible hazards, health and safety program development and health and safety monitoring.

#### Monitoring Program Components

Each monitoring program will be composed of the following elements:

- o Program Design and Rationale
- o Parameters to be Measured
- o Sampling Locations and Schedule
- o Sampling Methods
- o Analytical Methods

- o Data Analysis
- o Quality Assurance/Quality Control (QA/QC) Procedures

Program Design and Rationale. Program rationale and design for each monitoring program is based on the identification of probable impacts from project development. The rationale is provided for parameter selection, site selection and sampling regime. Sampling and sample analysis methods are discussed for each program. When appropriate, new methods for data analysis will be described in detail.

While it is agreed that a monitoring program is designed to detect changes and quantify environmental effects that occur, some programs may target specific objectives or potential impacts. For example, ground water monitoring must be designed to detect leachate contamination. Thus, this section defines the purpose of the program, specific program objectives and a general approach.

Parameters to be Measured. The parameters included in the program were selected because they met several criteria. First, each parameter relates to potential health and environmental concerns from oil shale project operations. Second, each parameter can be considered important in its sensitivity to environmental change and its value as an early indicator of potential impacts. Third, each parameter can be accurately and repeatedly measured while being cost-effective in terms of labor and analytical effort. Finally, the parameters have legal or regulatory importance or are important for overall monitoring efficiency.

Sampling Locations and Schedule. This section will indicate the way in which sample sites were chosen (spatial relationships) and an explanation of the quantity and number of sites used. In addition, the timing, or temporal relationships, of the sampling plan will be identified. This section will also detail the frequency, number of replicates, etc. of data collection to show consistency with program objectives.

Sampling Methods. This section will present a detailed discussion of the methods of data collection. Reference to established procedures will be included so that sampling methods can be uniformly applied. If new procedures are to be followed, an explanation of the method and an analysis of the methods effectiveness will be included.

Analytical Methods. Each program will employ scientifically accepted methods selected for their cost effectiveness, availability, and appropriateness for testing the variable being studied. Each method will be described or referenced.

Data Analysis. Data on parameters included in the EMP will be reported in a format and frequency determined through consultation with SFC, EPA, DOE and State of Utah agencies.

Quality Assurance Procedures (QA). This section will define the QA and quality control (QC) procedures used in the monitoring plan. Quality control assures that originally recorded data is accurate within the limits of the measuring device (i.e. instruments are working properly or observers are recording data correctly). Quality assurance is a system of activities to ensure that adequate checks are made of data accuracy (i.e. quality control is being conducted correctly) and may be viewed as "external quality control."

### Phased Approach

As was suggested by the EPA, an intensive phase of monitoring will be conducted in order to identify species of potential concern, followed by routine sampling of a more limited suite of parameters. During the monitoring program, the intensive (broad spectrum) monitoring effort will generally be conducted during the first year of operations. The second phase, when more limited monitoring will be employed, will generally commence during the second year of operations. Ambient monitoring will also be conducted during the preoperations phase in those instances where it is determined that additional data are needed to refine the data base.

## II. AMBIENT MONITORING

The Ambient Monitoring Program proposed by Paraho refers to the collection and analysis of data for the purpose of demonstrating compliance with appropriate statutes and agency requirements. This will involve assessing the environmental consequences of plant operation, identifying the potential for long-term impacts (i.e. seepage from ponds or leaks from underground pipes) and the comparison of existing with previously collected environmental data.

## AIR RESOURCES

Various air quality parameters have been monitored on and around the Paraho-Ute Project tracts since 1974. These data have been accepted by EPA and Utah Bureau of Air Quality as representative of baseline levels of air contaminants in the Uinta Basin region. Baseline levels of the major criteria pollutants have been established from continuous monitoring since late-1974, while baseline levels of the trace elements such as heavy metals, radioactive substances, visibility and other "non-criteria" elements, are based on a data set collected in 1975 and 1976.

### Program Design and Rationale

The following is a description of the ambient air quality monitoring plan to be implemented as the Paraho-Ute Project is constructed. The objectives of this monitoring plan will be to:

- o quantify the impact on air quality from the Paraho-Ute Project;
- o identify the presence of air contaminants with possible toxic or mutagenic action that may be associated with oil shale operations;
- o demonstrate that the impacts from Paraho-Ute are in compliance with National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act;

To achieve these objectives, the program will be designed with some knowledge of the expected air quality emissions and their impacts from the development of the Paraho-Ute Project. Such emissions have been estimated and impacts have been predicted through diffusion modeling,

with results presented in Paraho's PSD permit application report (1981). Based on the model predictions, two ambient air quality monitoring stations should suffice to determine air impacts for the project.

As noted in the Introduction, the program will be presented in a two-phased approach. Phase I will be an intensive stage of monitoring to determine which and how much of various suspected pollutants are present. For air contaminants, Phase I will commence with the start of operation since only then will gaseous releases become important. Phase II monitoring will begin one year after the commencement of operations or as appropriate. It is also planned that parameters not previously monitored in the baseline stage will be sampled periodically to determine their presence in the area before operations commence.

An example monitoring parameter list follows (Table 1).

TABLE 1

EXAMPLE

## PHASE I AMBIENT MONITORING (OPERATION ONLY)

<u>Criteria Pollutants</u>	<u>Frequency</u>	<u>White River(1) Baseline Available</u>
SO <sub>2</sub> , Ozone	(to be determined)	X
THC, NMHC		X
NO <sub>x</sub> , CO		X
TSP		X
Lead		
<u>Other Parameters(1)</u>		
Inhalable Particulates		
H <sub>2</sub> S, COS, SO <sub>4</sub>		H <sub>2</sub> S
NH <sub>3</sub> , NO <sub>3</sub>		
Trace elements(2)		X
Radioactive Substances		X
Organics(3)		
Cyanides(3)		
Metal Carbonyls		
Screening Test for Genotoxic Agents(3)		
Screening Test for Mutagenic Agents(3)		

- 
- (1) Specific compounds to be identified for organics and suspected gerotoxic or mutagenic agents.
- (2) Trace elements will include: Hg, F, Cd, Se, Sn, B, Be, As, S.
- (3) Quarterly monitoring of these may be desirable during construction to establish baseline values.

## WATER RESOURCES

This preliminary ambient program has been designed using existing data from the contiguous U-a/U-b tracts (White River Shale Project) and existing data from Paraho. The program is designed to monitor sediment, ground water and on-site surface water resources. These programs will be integrated with on-going and planned surface water monitoring programs related to other energy and water development projects. Additionally, supplemental ground water information (levels and quality) will be gathered on-site during the preoperation phase.

### Program Design and Rationale

Paraho proposes to conduct this program as follows:

- 1) Identify sources of oil, retort water, gas condensate, etc. that may affect water quality.
- 2) Identify the parameters of concern present in each source.
- 3) Compare the concentration of each parameter with existing standards and criteria and/or with toxicological and epidemiological data.
- 4) Select those parameters which exceed existing standards and criteria or which have important biological effects at the concentrations present in the effluent.
- 5) Determine the frequency of sampling by evaluating exposure routes, probability of release, and mobility in environment.

This five-step procedure may be coupled with a number of approaches advanced by the scientific community to simplify and focus monitoring for water quality without sacrificing information content. These techniques include:

- o indicators
- o surrogates
- o fingerprinting
- o biological testing

The use of surrogates and biological testing was also proposed by the U.S. EPA in their guidance documents for preparing ambient and source programs. The scientific basis for using each technique for oil shale monitoring will be presented.

Key aspects of this monitoring program are:

- o Indicator parameters and frequent biological testing is used in lieu of specific compound analysis.
- o Programs consist of short-term (Phase I) monitoring to validate existing data or collect new data, Phase II monitoring to assess impacts and demonstrate compliance; and contingency monitoring to evaluate impact of startup, plant upsets, and spills.
- o Pattern recognition techniques may be used to refine the monitoring program at pre-selected intervals.
- o Emphasis is placed on a small number of parameters which can be accurately analyzed and which are environmentally important.
- o Existing data base is used to select parameters which are relevant to the Paraho technology.

Example parameters selected for inclusion in the program, and recommended sampling frequencies for on-site sediment, surface water runoff and ground water stations are summarized in Table 2. Parameters

TABLE 2

EXAMPLEWATER QUALITY PARAMETERS AND FREQUENCIES(1)  
FOR THE AMBIENT WATER RESOURCES PROGRAM

	Phase I			Phase II			Contingency		
	<u>SED</u>	<u>SW</u>	<u>GW</u>	<u>SED</u>	<u>SW</u>	<u>GW</u>	<u>SED</u>	<u>SW</u>	<u>GW</u>
<u>Inorganics</u>									
Ag									
Al									
As*									
B									
Ba									
Be									
Br									
C, inorg.									
Ca									
Cd									
Cl									
Co									
COD									
CN									
Cr									
F									
Fe									
Hg									
K									
Li*									
Mg									
Mn									
Mo*									
Na									
Ni									
NH3									
NO3									
NO2									
Pb									
pH									
P04									
Rb									
Sb									
Se*									
Si									
S04									
Sn									
Sr									
TDS									
TSS									
Th									
Tl									

Monitoring Frequency to be determined

TABLE 2 (cont.)

	Phase I			Phase II			Contingency		
	<u>SED</u>	<u>SW</u>	<u>GW</u>	<u>SED</u>	<u>SW</u>	<u>GW</u>	<u>SED</u>	<u>SW</u>	<u>GW</u>
Ti									
V									
Zn									
Gross Alpha									
Gross Beta									
<u>Organics</u>									
Org.C, extr.*									
Org.C, diss.									
Org.C, HPO(2)									
Org.N*									
Org.S									
1-Alkenes									
Phenols									
Prior Pol. (3)									
SCN									
Specific									
Organic									
Compounds(4)									
<u>Biological</u>									
<u>Testing</u>									
Ames Test*									
EC 50									

(1) The monitoring frequencies are to be determined:  
W=Weekly; M=Monthly; Q=Quarterly; A= Annually; + twice  
daily or more frequently during upset conditions or  
following sustained excursions in indicator parameters;  
- = not recommended for monitoring.

(2) HPO = hydrophobic; HPO org. C can be determined  
rapidly by fractionating the sample with C-18 Sep Paks  
and measuring DOC in the column effluent.

(3) Prior. Poll. = Priority Pollutant.

(4) The following should be determined by GC/MS: benzene,  
toulene, methyl bromide, methylene chloride, trichloro-  
ethylene, ethylbenzene, phenol, naphthalene, fluorene,  
anthracene, phenanthrene.

\* = indicator parameters; sustained excursions in these will  
trigger the Contingency Monitoring Program.

## WILDLIFE

Monitoring activities will be conducted in order to assess the condition of significant wildlife on and adjacent to the Paraho site. The timing, intensity, and frequency with which the studies will be conducted is based upon the need to provide timely notice of detrimental effects or conditions, and upon the normal seasonal changes in wildlife in the area (Table 3).

### Program Design and Rationale

The major objective of the terrestrial fauna monitoring program is to determine if mining and processing of oil shale and related activities significantly affect the abundance and distribution of important wildlife species near the site. Thus, there are three major goals:

- o To determine if there is a departure from normal conditions.
- o If such a departure is discovered, to determine if this departure is caused by man's activities or if it is related to natural environmental changes.
- o To provide information concerning reclamation efforts.

TABLE 3

EXAMPLE

## SUMMARY OF WILDLIFE MONITORING ACTIVITIES

		<u>Location</u>	<u>Method</u>	<u>Frequency</u>	<u>Time</u>
o	Big Game Use Surveys (Deer and Antelope)	Project area and vicinity, along White River	Systematic observation	Monitoring frequency to be determined	
o	Wildlife Water Use	At water impoundments and along White River	Systematic observation		
o	Big Game Road Kill	Along access road	Systematic observation		
o	Raptor Nesting and Activity	Project area and vicinity	Systematic observation, Opportunistic sightings		
o	General Observations	Project area and vicinity	Systematic and opportunistic observation		

## VEGETATION

Vegetation monitoring will be conducted to: a) supplement and refine information contained in Paraho's Reclamation Plan (submitted with the Intention to Commence Minint permit to the Utah Division of Oil, Gas and Mining); b) serve as a measure of ecological health of the project area, and c) provide information concerning revegetation efforts.

### Program Design and Rationale

This monitoring program incorporates data from the baseline studies and an analysis on the projected development activities in order to document existing conditions and determine interactions between the vegetation and other factors on the Paraho tract (Table 4). Previous data combined with continued monitoring provides for two important advantages:

- o documentation of vegetation responses to natural fluctuations or variation that could otherwise be interpreted as impacts of development;
- o the ability to identify concerns regarding revegetation efforts at an early stage.

TABLE 4

EXAMPLE

## SUMMARY OF VEGETATION MONITORING ACTIVITIES

		<u>Location</u>	<u>Method</u>	<u>Time</u>
o	Vegetation Transect Studies	Adjacent to facilities and in revegetated areas		
o	Stem Leader Growth	Adjacent to project facilities	Monitoring frequency to be determined	
o	Sensitive Plant Species	Project area and vicinity		
o	General Observations	Project area and vicinity		

## SOILS

In conjunction with vegetation monitoring, project area soils will be surveyed to determine topsoil suitability and volume for reclamation planning purposes. This program will determine those soil properties (physical and chemical) essential for successful revegetation as required by the Division of Oil, Gas and Mining.

### Program Design and Rationale

The program will include field checks of soil mapping units and exact determination of mapping unit boundaries. In addition, the program will sample and analyze the genetic soil horizons within each mapping unit. The samples will be sent to an approved laboratory for analysis of physical and chemical properties in order to determine topsoil suitability and to characterize the soils. Additional soil sampling as required by the various state agencies may be performed during this phase. The soil series determined from the baseline program will be confirmed by verification with the Vernal Office of the Soil Conservation Service. The soils program will also characterize soil erosion occurring on the project site.

Although most on-site structures are designed for containment in case of spillage, a contingency soils sampling program will be implemented if "upset" conditions warrant.

### III. SOURCE MONITORING

Source monitoring refers to the collection and analysis of on-site effluents and emissions for the purpose of demonstrating compliance with appropriate statutes and agency requirements, and to provide early warning of facility conditions which require correction. Also, the performance of pollution control devices can be assessed through the examination of inlet and outlet stream concentrations. The Phase I program will commence with the generation of the first effluents or emissions and continue through the first year of operation of the facility after which the Phase II program will begin. Data pertinent to worker health and safety, collected during the source monitoring program will be made available to appropriate state and federal agencies. In addition, analyses of source monitoring data which will help characterize the worker environment will be included as inputs to the Occupation Health and Safety Program.

Paraho's source monitoring program will document the emissions from the following potential source areas:

- ° Mining, crushing and screening
- ° Final screening and shale storage
- ° Retorting and shale oil recovery
- ° Raw shale fines storage
- ° Retorted shale disposal
- ° Ammonia removal and sulfur recovery
- ° Hydrotreating
- ° Shale oil storage
- ° Product distribution
- ° Waste water treatment
- ° Power generation

Each of these areas will be described in terms of the processing units and their respective process streams, which will be characterized to

clearly identify the monitoring parameters of concern. Each unit will then be monitored for water and liquid effluent, air and gaseous emissions, and solid waste residues of significance.

Monitoring will continue during any abnormal operating conditions. Process modification effects will also be determined through such monitoring.

## AIR AND GASEOUS EMISSIONS

Source monitoring will be conducted for a variety of potential emissions from the Paraho facility (see Table 5 for sample monitoring parameter list). In addition, visual monitoring will be conducted as required by the PSD permit issued through the Utah Bureau of Air Quality.

### Program Design and Rationale

In conjunction with the ambient monitoring program for air resources, this program is designed to:

- o quantify emissions from the Paraho facility;
- o determine if the emissions originating from the Paraho facility are possibly toxic or mutagenic;
- o demonstrate compliance with the BACT determinations in the PSD permit issued by the Utah Bureau of Air Quality;
- o determine effectiveness of air pollution control equipment.

TABLE 5

## Phase I Source Emissions Monitoring.

	Parameters to be Monitored in Gaseous Discharges													
	CO	CH <sub>4</sub> / NMHC	C <sub>6</sub> H <sub>6</sub>	C <sub>6</sub> H <sub>5</sub> - OH	C <sub>3</sub> H <sub>5</sub> - N	HCN	NH <sub>3</sub>	TSP*	H <sub>2</sub> S	SO <sub>2</sub>	NO/ NO <sub>x</sub>	COS	Merc.**	Sp. Org.***
	Monitoring Frequency****													
<b><u>Combustion Flue Gases</u></b>														
Fuel Gas-Fired Process Heater/ Boiler (H <sub>2</sub> Plant Reformer and Hydrotreater Furnaces)	C	C	--	--	--	--	--	W	C	C	C	--	--	--
Gas Turbine Exhaust (Power Generation)	C	C	--	--	--	--	--	W	C	C	C	--	--	--
Waste Gas Incinerator	C	C	--	--	--	--	--	--	--	C	C	--	--	--
<b><u>Acid Gas Removal/Sulfur Recovery</u></b>														
Fuel gas stream from Stretford Sulfur Recovery Off-Gases	--	I	I	--	--	I	D	W	C	C	--	I	I	--
<b><u>Storage Tank Vent Gases</u></b>														
Crude & Hydrotreated Shale Oil		W	Only those constituents known to be present in the stored material											
Fuel Oil	--	W	I	I	I	I	W	W	W	--	--	--	AN	AN
<b><u>Fugitive Hydrocarbon Emissions</u></b>														
Process Equipment Seals, Reliefs	AN	AN	I	--	--	I	--	--	AN	AN	--	--	AN	AN
Piping and Fittings	AN	AN	I	--	--	I	--	--	AN	AN	--	--	AN	AN
Secondary Emissions from Water Treating	--	W	--	--	--	--	W	W	W	--	--	--	--	--

\* Tar and oil aerosols, trace elements as needed

\*\* Mercaptans

\*\*\* Specific organics

\*\*\*\* Monitoring frequency: C=continuous, D=daily, W=weekly, AN=as needed, I=Initially, to determine if any exists in emission stream

## WASTE WATER AND LIQUID EFFLUENT

The purpose of this program is to provide general characterization data on steady-state effluents, to provide early warning of any plant excursions which may lead to adverse environmental consequences, and to validate the operation of pollution control devices. Pattern recognition techniques may be used to refine and focus the program following each sampling period.

### Program Design and Rationale

The effluents in Table 6 are grouped according to common characteristics. The "process raw effluents" are the most highly contaminated waste streams due to their direct contact with the shale oil and retort gases. These streams are produced during shale oil recovery, retorting and shale oil storage, and hydrotreating, and they include retort water, refinery sour water, and ammonia scrubber sour water. These effluents are expected to have the least potential for environmental release because they are confined in closed pipes.

The "combined raw effluents" include process area runoff and wastewaters from the equalization basin at the head end of the process wastewater treatment system (stripped sour water, miscellaneous effluents).

The "treated effluents" refers to the two waste streams from the process wastewater treatment system water for conveyor cooling and shale wetting and for spray wetting retorted shale. Retorted shale run-off refers to flow off the retorted shale pile collected in retention ponds. Slow seepage through the pond may result in leachate migration through underlying strata. The final two effluent groups are common to other industrial facilities and are not expected to pose an environmental problem. These are "diversion runoff," which refers to the proposed release of uncontaminated precipitation runoff under a

TABLE 6

EXAMPLEPARAMETERS AND FREQUENCIES<sup>(1)</sup> RECOMMENDED  
FOR THE SOURCE MONITORING PROGRAM

<u>Parameter(2)</u>	<u>Process Raw Effluents</u>	<u>Combined Raw Effluents</u>	<u>Treated Effluents</u>	<u>Retorted Shale Runoff</u>	<u>Diversion Runoff</u>	<u>Inorg. Treat.</u>
<u>Inorganics:</u>						
Ag						
As*						
B						
Be						
C, inorg.						
Ca						
Cd						
Cl						
Co						
COD						
Cr						
Cu						
F						
Fe						
H <sub>2</sub> S						
Hg						
K						
Li*						
Mg						
Mn						
Mo*						
Na						
Ni						
NH <sub>3</sub>						
Pb						
pH						
Sb						
Se*						
Si						
SO <sub>4</sub>						

Monitoring Frequency to be determined

TABLE 6 (cont.)

<u>Parameter(2)</u>	<u>Process Raw Effluents</u>	<u>Combined Raw Effluents</u>	<u>Treated Effluents</u>	<u>Retorted Shale Runoff</u>	<u>Diversion Runoff</u>	<u>Inorg. Treat.</u>
TDS						
TSS						
Tl						
V						
Zn						
Selected						
Radioactive						
Parameters						
Organics:						
Org.C, diss.						
Org.C, HPO*						
Org.C, Volat.						
Org.N*						
Org.S						
Phenols						
Prior Poll.(3)						
CN						
SCN						
Biological Testing:						
Ames Test*						
EC 50						
Static 48-hr bioassay						

Monitoring frequency to be determined

- (1) The following abbreviations are used for monitoring frequency: D=Daily; W=Weekly; M=Monthly; Q=Quarterly; A=Annually; - = not recommended for monitoring.
- (2) The following abbreviations are used in the parameter listing: HPO=hydrophobic organic C (Daughton et al. 1982).
- (3) Prior. Poll. = priority pollutants; the specific priority pollutants to monitor are those identified in the Interim Program; during the Contingency Program, a single sample should be taken for priority pollutant analysis.
- \* = indicator parameters; sustained excursions in these will trigger the Contingency Monitoring Program.

NPDES permit, and "inorganic treatment," which includes the influent to (boiler blowdown, treated sanitary wastewater, filter backwash water) and effluent from the inorganic wastewater treatment system (makeup water for cooling tower).

The specific parameters and sampling frequency will be selected by evaluating effluent composition, potential for environmental release (i.e., seepage, percolation, spills), potential for worker contact, availability of routine and accurate analytical methods, and existing criteria, standards and toxicological data.

Criteria pollutants are those whose concentration in the untreated effluent exceeds existing standards and criteria for drinking water, agriculture, stock watering, and aquatic biota. Inorganic parameters were selected by comparing the concentration ranges of each effluent with published criteria and standards (Federal Reg. 1980; EPA 1974; EPA 1976).

Organic parameters were selected by determining the suspected toxicological and oncogenic properties of each class of compounds or of specific compound within each class (Sax 1979, 1981). Because of the large number of organic compounds and the general lack of adequate toxicological and other data on them, class or group indicators are used in combination with frequent biological tests and periodic specific compound analyses. Parameter selection criteria include: 1) the availability of accurate, rapid, and commercially available analytical instrumentation or methodology; 2) representation of one or more classes of compounds that include carcinogens or toxicants, and 3) low concentrations in the ambient environment.

## SOLID WASTE

All solid waste streams will be initially tested for hazardous or toxic characteristics. Process-oriented solid waste stream measurements will continue on a regular basis.

Monitoring for solid waste residues will primarily emphasize study of the processed shale disposal pile. Monitoring will include measurements of pile moisture, phreatic water levels, temperature, leachate water quality, and embankment stability. Monitoring for potential leachates will be conducted in conjunction with the wastewater and liquid emission (source) and water resources (ambient) monitoring programs. Monitoring for air and gaseous emissions will be defined by the air and gaseous emissions (source) and air resources (ambient) monitoring programs.

#### IV. OCCUPATIONAL HEALTH AND SAFETY MONITORING PROGRAM

The Occupational Health and Safety Monitoring Program will include the following major components: identification of possible hazards to worker health and safety; health and safety programs, and health and safety monitoring. The elements of each component are briefly outlined in the following sections.

## IDENTIFICATION OF POSSIBLE HAZARDS

Health concerns and safety hazards will be identified through a systematic evaluation of the facility under normal and contingency operating conditions. Systems to be evaluated will include the major process areas, the process materials and emissions, and the occupational categories.

### Process Areas and Components

Process units will be described and potential health and safety concerns will be identified. Process areas include:

- ° Mining, crushing and shale handling
- ° Retorting and shale oil recovery
- ° Raw shale fines storage
- ° Retorted shale disposal
- ° Ammonia removal and sulfur recovery
- ° Hydrotreating
- ° Shale oil storage and transmission
- ° Waste water treatment
- ° Power generation

### Process Materials and Emissions

Process materials and emissions will be characterized on a plant-wide basis to identify potential health and safety concerns, including:

- o Exposure to toxic and hazardous substances; e.g. arsenic, toluene, benzene, methane, ammonia, carbon monoxide, hydrogen sulfide, suspected carcinogens, etc.
- o Exposure to high temperatures, noise, dust and vibrations.
- o Potential for spills, explosions, ground fall and fires in the workplace.

### Occupational Categories

Worker occupations will be evaluated systematically to identify health and safety concerns by comparison to published information for similar workplace environments. Example categories include miners, heavy equipment operators, machinery maintenance personnel, laboratory workers, etc.

## HEALTH AND SAFETY PROGRAM

A program will be developed which will include the following elements to provide for the health and safety concerns identified in the previously discussed analysis:

- o Training programs for personnel safety, e.g. mine safety training, industrial hygiene.
- o Design considerations to minimize hazards, using best engineering practices.
- o Protective equipment requirements, e.g. safety shoes, hard hats, eye protection, etc.
- o Health and safety monitoring programs, e.g. medical surveillance.
- o Inspection procedures.

## HEALTH AND SAFETY MONITORING

The health and safety monitoring program will include medical monitoring, occupational health monitoring, personnel monitoring, and safety monitoring. Medical monitoring will involve physical examinations of workers and may include x-rays, blood and urine samples, cancer screening tests and other tests as appropriate.

Occupational health monitoring will involve a network of analyzers and area monitors to ensure that hazardous substances and emissions are not present in harmful quantities in the workplace. Leak detection monitors, noise monitors and portable analyzers will be employed on a regular basis in suspected hazard areas.

Personnel monitoring will be conducted using portable analyzers to spot check the workplace environment for respirable dust, compounds of known toxicity and noise.

Safety monitoring will involve the use of personnel to regularly observe and ensure the worker's application of proper safety procedures and protective equipment.